PERFORMANCE OF WHEAT VARIETIES IN RELATION TO DATE OF HEADING

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PERFORMANCE OF WHEAT VARIETIES IN RELATION TO DATE OF HEADING

The varieties of wheat grown in any country show wide diversity of type. There are early as well as late varieties. Usually some varieties perform better than others under certain environmental conditions. Diversity in performance and other characters has been of great importance to plant breeders. Variable types have been greatly used in evolving types with desirable characters. A knowledge of inheritance and relative value of the characters is of great importance in the rapid and efficient solution of plant breeding problems, as such information furnishes an effective approach. But the mode of attack is not clearly recognized until the desirability of different characters of different varities is worked out on a comparative basis and their relation to each other is definitely known. Since there was little information regarding the influence of date of heading on the development of different characters in wheat and regarding the relations between the different characters themselves, the main effort in the studies reported here, was devoted to a comparative study of the entire life process of 11 varieties of wheat, ranging from early to late. Correlations were calculated between date of heading and the developmental characters and between the characters themselves.

Materials And Methods

Eleven varieties of winter wheat ranging from early to late were studied. They are shown in table 1 with their obvious characters. All varieties were pure except variety 3 which segregated for spike and kernel characters and variety 7 for kernel color only.

Table 1—Varieties of wheat used in this investigation together with their obvious characters

Variety	Characters			
	Av. no. of days required for heading after 30th April	Spike	Glumes	Kernels
1. 47-268 Rex x Wabash	24.8	awnless	brown	red
2. 44-593-3 Rex x Hungarian Fl / Trumbull x 37-1153 Fl	27.2	awnless	white	white
3. 47-285 Rex 37-1153 Fl / 40- 1205	28.4	awnless & awned	white	red & white
4. Rex	29.3	awnless	brown	white
5. Oro C. I. 11673	29.4	fully bearded	white	red
6. Rex x 37-1153	30.4	awnleted	white	white
7. Bulked Hybrid Ukrainka / Oro-Tenmark	31.1	fully bearded	white	red & white
8. 43-254-9 Fulcaster x Wabash / Golden x Ill 2	32.0	awnleted	white	red
9. Ukrainka	34.2	fully bearded	white	red
10. Genesse giant	34.9	fully bearded	brown	white
11. Nisped x Triticum timopheevi	43.1	awnleted	white	red

The experiments reported were conducted during the season 1947-48. Seeds were sown in 5 randomized blocks. A single seed was sown per hill at a distance of 6″ in 2 rows 1′ apart and altogether 66 seeds of each variety were sown in each replication. Observations were taken both in the field in the standing crop and in the field laboratory after harvest. Mean values were calculated for each replication and all data thus obtained were analyzed statistically by the analysis of variance procedure. The correlation coefficients were calculated from the means of each variety for respective characters. In some cases other methods were employed in interpreting the results.

Experimental Results

Means of varietal characters are shown in table 2.

1. Germination and winter survival —

Percentage of germination ranged from 30.7 to 81.2% and winter survival from 83.92 to 94.84%. Differences were significant in both cases. Medium maturing varieties survived better than early and late ones.

2. Tillering —

Tillers were recorded for 10 plants of each replication in the early fall and early spring and from 15 plants of each replication after harvest. The differences in the tillering habits of these varieties were significant at all these periods of development. No relationship was found between tillering habits of early fall and final tillers.

3. Date of heading —

The emergence date of first head of each plant was recorded to determine the average heading dates of all the varities. Varieties showed wide range in their heading dates. The earliest variety averaged 24.8 days and the latest variety 43.1 days after 30th April. Though the difference in heading date was significant in all cases except between 2 varieties, the difference was still not very marked in several cases; e.g., difference between the heading dates of varieties 2 and 3 was hardly a day. Similar was the case in heading dates of varieties 6, 7, and 8 and varieties 9 and 10.

4. Uniformity of head emergence of tillers —

The date of emergence of heads of all the tillers in 25 plants of each variety was recorded. Varieties 3, 6, 7, 8, and 9 completed emergence of heads in comparatively less number of days than others, which indicates they are more uniform in their emergence of heads than other varieties. A positive correlation was found between number of heads and average number of days required for completion of heading.

Table 2—Means of characters of 11 varieties of winter wheat, arranged in order of date heading

Characters	Varieties											
	1	2	3	4	5	6	7	8	9	10	11	M.D. at 5% level
1. % of germination	65.70	64.50	78.10	55.50	30.70	81.20	74.20	68.40	32.40	62.40	41.20	14.99
2. % of winter survival	91.58	83.92	91.64	93.06	94.12	94.54	91.70	94.58	90.12	86.60	87.00	4.71
3. Head-bearing tillers	19.24	17.78	21.68	19.28	29.02	21.18	23.10	19.80	24.94	13.58	20.34	5.34
4. Av. No. of days taken for heading after 30th April	24.84	27.19	28.37	29.32	29.44	30.35	31.07	31.95	34.15	34.86	43.13	0.58
5. Ht. of plants (cm)	107.08	114.10	116.66	112.80	109.00	130.28	120.78	142.20	126.76	108.08	131.74	5.10
6. Length of spike (cm)	10.11	10.35	11.93	12.19	10.35	10.97	11.86	13.94	14.26	11.35	17.24	0.66
7. No. of spikelets per spike	21.46	21.48	24.20	21.05	19.24	21.56	22.47	24.57	25.55	24.85	28.44	0.44
8. Density of spike	21.10	21.07	20.28	17.24	18.59	19.65	18.95	17.63	17.92	21.89	16.94	
9. No. of sterile spikelets per spike	0.89	0.70	1.07	0.25	0.90	0.77	1.30	1.68	0.75	1.05	0.63	0.47
10. No. of kernels per spike	53.95	58.23	60.01	58.88	55.60	50.15	56.70	64.95	62.31	82.85	61.73	6.03
11. Wt. of kernels per spike (gm)	2.64	2.77	2.87	2.82	2.75	2.30	2.94	3.18	3.10	3.99	2.59	0.25
12. Yield of kernel per plant (gm)	32.85	29.55	37.43	31.54	40.91	27.13	36.05	37.81	38.74	31.64	24.82	6.54
13. Plumpness of kernels (gm)	3.33	3.58	3.73	3.85	3.88	3.61	4.07	4.34	3.30	4.19	3.18	

M.D. — mean difference necessary for significance between 2 means

A marked decline in the grain yield of heads emerging on successive days was noted in the plants of all the varieties. The coefficients of regression between date of heading of tillers and weight of grain per spike vary from variety to variety but in no case can such regression take place simply from chance. Average coefficients of regression for the varieties under study was 0.15.

5. Height of plants and number of internodes —

Varieties under study showed distinct varietal differences in their heights, number of internodes and average length of internodes. There were positive correlations between date of heading and number of internodes and height of plants.

6. Head characters —

The following head characters were studied from the main culm of 15 plants of each replication: (1) length of spikes, (2) number of spikelets, (3) density of spikes (4) number of sterile spikelets, (5) number of kernels per spike, and (6) weight of kernels per spike. Varieties differed significantly in all these characters except in a very few cases only.

7. Yield per plant —

Varieties varied in their yielding ability and the differences were statistically significant except in a few cases. Yield per plant was determined from 15 plants of each replication selected at random. Yield per plant was influenced by number of heads and the other 6 head characters mentioned above. Variation in yield was mainly due to differences in the following characters: (1) number of heads per plant, (2) average size of heads, and (3) size of kernel.

8. Correlations —

Correlations were calculated using the means of the respective characters.

A. Significant and positive correlations were found between the following characters.

		Correlation coefficient 'r'	Value of significant 'r'
(1) Date of heading	(a) Number of spikelets per spike	+0.806	0.449
	(b) Number of sterile spikelets	+0.946	0.245
(2) Fall tillers	(a) Spring tillers	+0.608	0.597
(3) Spring tillers	(a) Head-bearing tillers	+0.673	0.556
(4) Length of culm	(a) Length of spike	+0.835	0.414
(5) Length of spike	(a) Number of spikelets	+0.852	0.394
(6) Number of kernel per spike	(a) Weight of kernel per spike	+0.903	0.325
	(b) Size of kernel	+0.650	0.534
(7) Total number of tillers	(a) Average number of days required for completion of heading	+0.620	0.590

B. Correlations between the following characters were positive but not significant.

(1) Date of heading	(a) Winter injury	+0.293	0.720
	(b) Number of internodes	+0.031	0.752
	(c) Height of plants	+0.117	0.794
	(d) Length of spike	+0.469	0.664
	(e) Number of kernels per spike	+0.412	0.686
	(f) Weight of kernel per spike	+0.190	0.739
(2) Head-bearing tillers	(a) Yield per plant	+0.571	0.617
(3) Length of spike	(a) Number of sterile spikelets	+0.133	0.745
(4) Number of spikelets per spike	(a) Number of kernels per spike	+0.474	0.662
(5) Plumpness of kernels	(a) Yield per plant	+0.379	0.696
	(b) Weight of kernels per spike	+0.478	0.613
(6) Number of kernels per spike	(a) Yield per plant	+0.014	0.752

C. Negative and significant correlation was found between

(1) Length of spike	(a) Density of spike	−0.710	0.530

D. Correlations between the following characters were negative but not significant.

(1) Date of heading	(a) Number of head-bearing tillers	−0.111	0.748
	(b) Yield per plant	−0.366	0.700
	(c) Plumpness of kernels	−0.217	0.734
(2) Fall tillers	(a) Head-bearing tillers	−0.030	0.740
	(b) Total number of tillers	−0.048	0.744
(3) Height of plants	(a) Yield per plant	−0.039	0.752
(4) Total number of tillers per plant	(a) Total period during which the heads emerged	−0.188	0.740
(5) Number of heads	(a) Number of kernels	−0.544	0.600
	(b) Size of kernels	−0.270	0.720

Discussion And Conclusions

From evidence presented it is definitely concluded that the varieties differ in their varietal developmental characters and that their performance depends largely on the number of heads per plant, size of heads, and average weight of kernels.

The correlations found in the characters studied, are genetic because the growth conditions for all varieties were the same and correlation coefficients were calculated on the means of the varieties. They show the nature of relationships that exist between different characters and explain why certain varieties perform better than others.

Correlation coefficients either positive or negative may be desirable or undesirable depending on the characters being considered. The positive correlations between date of heading and yield components, length of spike, number of spikelets, and kernels are desirable for the performance of late varieties, while the same between date of heading and winter injury and and number of sterile spikelets are undesirable for them.

Negative correlations between date of heading and number of head-bearing tillers, yield per plant, and plumpness of kernels indicate that early varieties perform better than late ones. So earliness is a desirable character, for early varieties not only perform better than late ones but also escape rusts and other diseases and weather hazards.

Positive correlation between plumpness of kernels and yield per plant indicates the importance of size of kernels on the performance of varieties. Size of kernel is associated with earliness which again explains the importance of earliness.

Highly significant positive correlation between number of kernels and yield per spike shows the importance of kernel number in the performance of a variety.

Negative correlation between height of plants and yield shows that short-stemmed varieties perform better than varieties with long stem.

It has been definitely proved that early varieties perform better than late ones. Performance of varieties was not adversely affected by external conditions and so the varieties displayed their inherent qualities in their performance under the conditions in which they were grown. Early varieties escape pests, diseases and other weather hazards for they generally occur late in the season. Some of the late varieties possess desirable characters like long spikes, large number of spikelets, and kernels. In a crossbreeding experiment for transmitting these desirable characters, one may find that lateness, sterility of spikelets, etc., undesirable characters, are also transmitted along with the desirable ones. Selection as well as back cross methods may be followed for getting the plants with the desirable characters only.

VITA

The author was born on a farm in the village Durgarampur, district Tipperah, Eastern Pakistan, on 1st of February, 1919. He attended public school of his home community for primary education. He matriculated from district Govt. school, Comilla, University of Calcutta in 1934. He then passed intermediate science examination from Comilla Victoria College, University of Calcutta in 1936. He received the degree of Bachelor of Science in Physics, Chemistry and Mathematics in 1938 and Botany and Soil science in 1939 from the University of Dacca. He received the degree of Master of Science in Botany from the University of Calcutta in 1941. Next he was deputed by the Govt. of Bengal for practical training in plant breeding in the Indian Agricultural Research Institute, New Delhi, wherefrom he received the diploma of the Associateship of the Indian Agricultural Research Institute in 1943.

He was a student of high average merit and in consideration of his merit he has received financial aids from different institutions where he studied and from his government through out his student career.

He was appointed as assistant botanist in Rice research project under the First Economic Botanist, Bengal on 22nd November, 1943. In April 1946, he was appointed to act as Assistant Fibre Expert, Bengal in the Fibre and Fodder crops breeding project, at which post he served till the 21st of June 1947. He was selected for further advance studies in plant breeding by the Government of Bengal, 1946.

He is a member of the Indian Society of Genetics and Plant Breeding, The Botanical Society of Calcutta, and The Botanical Society of Dacca. He is also affiliated to the American Society of Agronomy.